SECTION 607 – PROTECTIVE MANHOLE COATING (TYPE A)

1. GENERAL

This specification describes the procedures for the reconstruction of manholes by low velocity spraying of pre-blended fiber reinforced cementitious mortar. The reconstruction process shall provide a monolithic liner capable of stopping infiltration and restoring structural integrity.

The Contractor shall furnish all labor, equipment and materials for applying a cementitious mortar to form a structural monolithic liner of a minimum 1/2 inch thickness. Contractor shall use machinery specifically designed and manufactured by the material supplier for low velocity application. All aspects of the reconstruction shall be in accordance with this specification which includes the removal of any loose and unsound material; cleaning of the area by spraying with high pressure water; the repair and sealing of the invert and benches; the elimination of active infiltration prior to making the application; and the spray application of a cementitious mortar to form a structural monolithic liner.

2. MATERIALS

A. Patching Material. A quick setting, fiber reinforced, corrosion resistant cementitious material shall be used as patching material and is to be mixed and applied according to manufacturer's recommendations. The patch material shall meet the following minimum requirements:

Compressive Strength	ASTM C109	1400 psi, 6 hrs.
Bond	ASTM C952	145 psi, 28 days
Cement		Sulfate resistant
Applied Density		105 lbs $\pm$ 5 lbs pcf
Shrinkage	ASTM C596	1% at 90% R.H.

B. Infiltration Control Material. A rapid setting hydraulic plug shall be used to stop minor water infiltration and shall be mixed and applied according shall meet the following minimum requirements:

Compressive Strength	ASTM C109	400-600 psi, 1 hr.
1800-2400 psi, 24 hrs.		
Expansion	ASTM C827	10%
Sulfate Resistance	ASTM C267	No weight loss after
15 cycles, 2000 ppm		
Freeze/Thaw	ASTM C666	100 Cycles
(method A)		
Pull out strength	ASTM C234	14000 lbs
Placement time	ASTM C191	<60 seconds

C. Liner Material. The cementitious liner material shall be speciffically designed for low velocity spray application and shall require only the addition of water at the job site. The proposed material shall have a minimum 5 year history of use for manhole reconstruction. Manufacturer shall provide a reference list of 10

different projects that demonstrate successful use of proposed material. The liner material shall be a factory blended cementitious material made with Type I or III portland cement, pozzolanic materials, silicious aggregates, fiberglass rods and other additives. The cement content shall be no less than 40% of total weight. Fiberglass rods shall be manufactured from AR glass with no rod less than 1/2 inch nor greater than 5/8 inches in length. The blend shall have a dry bulk density of 65-67 pounds per cubic foot and when mixed with manufacturer's recommended amount of water shall have a wet density of 120 pcf ± 5 pounds. Cured physical properties shall meet the following minimum requirements:

Compressive Strength	ASTM C109	5,000 psi
Tensile Strength	ASTM C496	600 psi
Flexural Strength	ASTM C78	700 psi
Shrinkage @ 90% R.H.	ASTM C596	0%
Bond	ASTM C952	130 psi
Sulfate Resistance	ASTM C267	ph> 3
Freeze/Thaw	ASTM C666	No visible damage

D. Water. Water used to mix product shall be clean and potable. Water temperature shall not exceed 80 degree F.

3. EQUIPMENT

Contractor must use approved equipment designed and manufactured by the material supplier specifically for low velocity spraying of pre-blended cementitious materials. To insure consistency of material, equipment shall be designed for wet-mixing and progressive cavity pumping with no water added at the nozzle. Remote delivery systems shall not be used. Contractor must provide current documentation certifying they are factory trained on the equipment used and are an approved applicator of the materials proposed.

4. RECONSTRUCTION PROCEDURE

A. Preparation. Place covers over invert to prevent extraneous material from entering the sewer lines. All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 1200 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick setting, specially formulated mixes according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application. After application the weep holes shall be plugged with the quick setting material. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.

B. Invert Repair. After all preparations have been completed, remove all loose material and wash wall again. Any bench or invert repair shall be made at this time using quick setting patching mix and shall be used per manufacturer's recommendations. Invert repair shall be performed on all inverts with visible damage or where infiltration is present. After blocking flow through the manhole and thoroughly cleaning invert, the quick setting patch material shall be applied to the invert. The material shall be troweled uniformly onto the damaged invert at

a minimum thickness of 1/2 inch at the invert extending out onto the bench of the manhole sufficiently to tie into the monolithic liner to be spray applied. The finished invert surfaces shall be smooth and free of ridges. The repaired invert shall be formed in such a manner as to create a smooth flow line with proper slope. The flow may be re-established in the manhole within 30 minutes after placement of material.

C. Mixing Of Liner Materials. For each bag of product, use the amount of water or water settings required per manufacturer's recommendations following mixing procedures noted on product bag and using the approved equipment for mixing and application. Prepared mix shall be discharged into a hopper and mixing shall continue to occur in such a manner as to allow spraying continuously without interruption until each application is complete. Precautions shall be taken to keep the mix temperature at time of application below 90 degrees F.

D. Spraying. Immediately prior to spraying, the surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water. Materials shall be spray applied to the wall from the bottom to the top of the corbel, terminating at the base of the frame. Spraying shall be performed in such a manner as to insure full penetration into joints, cracks or voids with a final minimum thickness of 1/2 inch. The surface is then trawled to a relatively smooth finish being careful not to over trawl. A brush finish shall be applied to the trawled finish coat surface. The invert covers shall be removed at this time and the bench sprayed in such a manner that a gradual slope is produced from the walls to the invert with the thickness at the invert to be no less than 1/2 inch. The wall/bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

5. CURING

Caution should be taken to minimize exposure of applied product to sunlight and air movement. If time between application of additional coats is to be longer than 15 minutes, the structure shall be covered. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before covering or closing access. On extremely hot or arid days, manhole should be shaded while reconstruction is in process and a concrete curing agent should be used if the humidity level is below 70º. The final application shall have a minimum of eight (8) hours cure time before being subject to active flow or surcharge.

6. WEATHER

No application shall be made to frozen surfaces or if freezing is expected to occur within the substrate within 24 hours after application. Precautions shall be taken to keep the mix temperature at time of application below 90 degrees F.